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Patent Application of  
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for

**COLLAPSIBLE BABY STROLLER  
AND RELEASABLE LOCKING AND FOLDING MECHANISM THEREFOR**

**BACKGROUND OF THE INVENTION**

**1. Field of the Invention**

The present invention relates to wheeled infant carriages or designed to carry an infant smoothly and safely while walking, jogging or traversing uneven, rough, or unpaved terrain. And more particularly to a design conveniently portable and collapsible.

**2. Description of The Prior Art**

Traditionally, baby strollers have been used to push an infant slowly on a relatively hard, smooth floor or paved surface. As a result, the strollers were made with short wheeled bases and small wheels. These strollers work well at slow speed, but are extremely unwieldy and even dangerous on rough surfaces or at higher speeds.

As parents have become more health conscious, jogging and fast walking have become popular pastimes. Because baby strollers were not designed to be operated at high speed or on rough terrain, it was infeasible for a parent to jog or walk fast using a traditional baby stroller. Even for non-jogging parents, the need for an improved baby stroller has been apparent. The small,

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plastic wheels and short wheel bases customarily used for the baby strollers are almost useless when it is desired to walk with an infant in a grassy park or on a rough road or sidewalk. Parents end up not walking with the infant at all or only walking in limited areas.

Recently, all-terrain baby strollers have been designed to overcome these problems. These strollers typically employ much larger wheels and longer wheel bases. The stroller frame and frame connections are constructed to be stronger and larger to handle the heavy-duty use they may receive. These all-terrain strollers have their drawbacks. The increased size has made them difficult to store and transport and the folding/collapsing mechanisms are time consuming and cumbersome. For this reason, the present invention provides a quick and easy method of collapsing the stroller for storage or transport.

### 3. Objects and Advantages

Collapsible strollers are not a new concept. The collapsing process for most strollers, however, typically requires the use of both hands, often requires the application of large forces, and may be dangerous due to scissoring of truss-like members of the stroller structure. Most collapsing mechanisms are not intuitive to the user and require a lesson from a sales person or studying of instructions. Often, the parent is holding packages or the infant in one arm and has only one hand free to collapse and stow the stroller. The present invention provides an intuitive folding mechanism, requiring only one hand to collapse or unfold the stroller. Safeguards assure that the stroller collapses only when desired by the parent. Further, there are no pinch points or scissoring members in the folding mechanism.

When jogging with a conventional all-terrain stroller, the axle connecting the two rear tires often impedes the stride of the jogger (especially joggers with long strides). In the present invention, the rear wheels are cantilevered, giving the jogger clearance for a long stride.

Other novel features of the design are the use of an over-center mechanism to deploy a sun canopy on the stroller and another over-center mechanism to engage a foot-activated parking brake.

## SUMMARY OF THE INVENTION

The present invention is an all terrain/jogging, portable, collapsible baby stroller. The stroller frame consists of three cantilevered, tubular sections, which are hinged and constrained to move together by a means for such purpose. The three cantilevered sections are the front fork, which holds the front tire, the handle bar, and the rear support, on which the rear tires are mounted.

The means for hinging and constraining the motion of the cantilevered sections consists of a mechanism on either side of the stroller. Each mechanism consists of two meshing partial gears and a spring-loaded piston, which moves in line with the rear support. Secured to the side of each gear is a knife blade follower, which comes in contact with the piston in the locked and unfolded position. One gear is fixed to the front fork while the other is fixed to the handle bar. In the locked and unfolded position, the rotation of the gears with respect to one another is constrained by a flat in one direction and the knife blade followers against the extended spring loaded piston in the other direction. The cantilevered sections are constrained at fixed angles to one another. In this embodiment, the front fork forms approximately a 90-degree angle with the rear support and approximately a 180-degree angle with the handle bar. The rear support bisects the angle between the handle bar and the front fork.

To collapse the stroller, the stroller is lifted by a strap which is connected on either end to a lever, which depresses the spring-loaded piston on each side of the stroller. With the depression of the spring-loaded piston, the rotation of the gears relative to one another is no longer constrained. Continuing to hold the strap causes the stroller to collapse under its own weight; all of the cantilevered sections rotate into positions approximately parallel to one another.

The front fork consists of two separate pieces of tubing. At one end, each piece is fixed to the folding mechanism. At the opposite end a notch is cut in each tubular piece to accommodate the axle of the front tire. The notch allows the user to quickly remove the front tire.

The handle bar is made from a single piece of tubing or bar stock bent through 180 degrees so that the ends of the piece are parallel to one another. Each end is fixed to one of the two folding

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Each over center mechanism consists of a casing, a spring-loaded rod and a rotating piece. The spring-loaded rod is constrained as a slider joint by the casing and as a pin joint by the rotating piece. The casing is fixed to the handle bar and the rotating piece is fixed to the batten. The rotational freedom of the rotating piece is constrained by a groove in the casing. Because of the motion constraints on the rotating piece, the canopy will become fully deployed if the canopy is moved more than half way to the deployed position or fully retracted if the rotating piece is moved less than half way to the deployed position.

The hub assembly also houses a foot brake. The foot brake employs an over-center mechanism similar to the one used for the canopy deployment. The foot brake lever, typically made from stamped steel, is pinned to the hub assembly casing. When the lever is rotated, a finger, which is part of the lever, engages with a toothed disk, which is fixed to the wheel. The rotating motion of the lever is affected by an over-center mechanism. The over-center mechanism consists of a spring-loaded rod, pinned to the lever on one end and fixed as a slider by the hub assembly casing on the other end. When the lever is between the fully-engaged and the fully-

disengaged positions, the over-center mechanism tends to move the lever to either position. Another important feature to the design of this foot brake is the use of plastic or metal balls on the rod, between which the spring seats. The balls prevent the spring from binding on the hub assembly casing or the lever and allow low friction movement.

### BRIEF DESCRIPTION OF THE DRAWINGS

The above features, advantages, and object of the present invention will more fully be appreciated through consideration of the following drawings in which:

FIG 1 shows an isometric view of the present invention, a collapsible all-terrain stroller.

FIG 2 shows an exploded view of the folding mechanism, which allows the user to easily fold and unfold the stroller.

FIG 3 shows orthogonal views depicting the functionality of the folding mechanism.

FIG 4 shows an exploded view of the canopy deployment mechanism.

FIG 5 depicts the functionality of the canopy deployment mechanism.

FIG 6 shows an orthogonal view of the hub assembly.

FIG 7 shows isometric and orthogonal views of the folding procedure.

### REFERENCE NUMERALS IN DRAWINGS

2	Front Fork
3	Rear Support
4	Handle Bar
10	Folding Mechanism
11	Outer Half of Folding Mechanism Case
12	Inner Half of Folding Mechanism Case
13	Forward Partial Gear
14	Rear Partial Gear
15	Knife Blade Follower on Forward Partial Gear
16	Knife Blade Follower on Rear Partial Gear
17	Spring Loaded Piston
18	Release Lever
19	Fulcrum Plate
20	Fulcrum Pin
21	Gear Hubs
22	Spring for Piston
30	Front Wheel
32	Foot Rest
34	Release Strap
36	Infant Seat
40	Hub Assembly

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41	Hub Assembly Case
42	Quick Release Pin
43	Quick Release Spring
44	Brake Lever
45	Brake Lever Fulcrum
46	Over-center Mechanism Rod
47	Over-center Mechanism Spring
48	Nylon Balls
49	Toothed Disk
50	Assembly Bolts
51	Rear Axle
60	Mechanism for retracting Canopy
61	Over-center Mechanism Rod
62	Canopy Deployment Mechanism Casing
63	Rotating Piece
64	Forward Canopy Batten
65	Over-center Mechanism Spring
66	Fastener from Casing to Handle Bar
67	Fastener from Casing to Handle Bar, mating with groove in rotating piece
68	Fastener about which rotating piece rotates
69	Canopy

## DETAILED DESCRIPTION OF THE INVENTION

### 1. Overall Stroller Configuration

Referring now to the drawings, particularly FIG 1, there is shown a three-wheeled all terrain collapsible infant stroller. Three rigid assemblies 2-4, which are connected to one another via two folding mechanisms 10, form the fundamental structure of the stroller.

The front fork 2 consists of two pieces of tubing 2a-2b. One end of each front fork section 2a-2b is notched in order to accommodate the axle of the front wheel 30, allowing for easy disassembly. The other end of each front fork half 2a-2b is attached to a folding mechanism 10. A footrest 32 is secured to both halves 2a-2b of the front fork 2 above the front wheel 30.

The rear support 3 consists of two rear legs 3a-3b and a cross brace 3c, which are made from tubing. For each leg 3a-3b, one end is secured to a folding mechanism 10 and the other secured to a hub assembly 40. The cross brace 3c is secured to both rear legs 3a-3b, sufficiently close to the folding mechanism 10 to provide clearance for long strides.

The handle bar 4 is made from a single piece of tubing or bar stock, bent through 180 degrees. Each end of the handle bar 4 is secured to one of the two folding

mechanisms 10. A retractable canopy 60 is attached to the handle bar 4 in order to protect the infant from the elements.

## 2. *Releasable Locking and Folding Mechanism*

A key feature of the present invention is a novel folding mechanism 10. An exploded view of the folding mechanism 10 is shown in FIG. 2 and a functionality view is shown in FIG. 3. The folding mechanisms 10 control the angles between the front fork 2, the rear support 3, and the handle bar 4, and thus enables the user to collapse or unfold the stroller with ease. Within the folding mechanism are two meshing partial gears 13-14, made of stamped steel in the preferred embodiment of the present invention. The gears 13-14 rotate about gear hubs 21, which are fixed to the folding mechanism case, consisting of a outer 11 and inner 12 half. Partial gear 13 has an appendage which is fastened to the handle bar 4 and partial gear 14 has an appendage which is fastened to the front fork 2. The case 11-12 is secured to the rear support 3. The meshing of the gears 13-14 constrains the relative angle between the handle bar 4 and the front fork 2, so that when the handle bar 4 is rotated toward the rear support 3, the front fork 2 rotates toward the rear support 3 and vice versa. This is a key feature in the design because it enables the stroller to be unfolded by merely lifting on the handle bar 4. Gravity rotates the handle bar 4 away from the rear support 3, and the front fork 2 swings out into position.

It is desired to keep the stroller in a locked and open position until the user wishes to fold it up for storage or transport. The folding mechanism 10 contains features to accomplish this. Each gear 13-14 has a knife blade follower 15-16, made from stamped steel in the preferred embodiment, fastened to it. Knife blade follower 15 is fixed to the inner side of partial gear 13 and knife blade follower 16 is fixed to the outer side partial gear 14 so that the followers 15-16 do not interfere with one another when the stroller is collapsed. When the stroller unfolds into a fully open position, a piston 17, is pushed down by the knife blade followers 15-16 against a loaded spring 22 until the followers 15-16 reach the fully open position and the piston 17 is forced between the followers 15-16 by the spring 22. Thus the rotation of the handle bar 4 and front fork 2 relative to the rear support 3 is constrained by a lack of gear teeth in one direction and the knife blade followers 15-16 against the spring-loaded piston 17 in the other direction.

A key feature of the folding mechanism 10 is that the piston 17 and followers 15-16 are engaging in a wedging manner due to the angled piston 17 - follower 15-16 engagement surfaces. This wedged piston 17 has sufficient travel to accommodate manufacturing tolerances and wear accumulations by continuing to wedge the followers apart until the mechanism 10 is firmly locked open. The piston spring 22 is adequately sized to always drive the piston 17 into its highest possible position, maximizing the rigidity of the entire frame structure.

It is also desired to be able to easily collapse the stroller for storage or transport. The stroller is unable to collapse until the spring-loaded piston 17 is retracted so that the gears 13-14 are free to rotate relative to the case 11-12. In order to retract the spring-loaded piston 17, a release lever 18 rocks about fulcrum pin 20, which is held in place by fulcrum plate 19. The fulcrum plate 19 is fastened to the inner half 12 of the case so that when a force is applied to the long arm of the release lever 18, a force which tends to retract the spring-loaded piston 17 is generated.

In the preferred embodiment of the invention, a release strap 34 is connected to the release lever 18 on both folding mechanisms 10. The release strap 34 lays in the seat 36 so that when the infant is removed from the stroller, the parent can lift on the release strap 34, which retracts the spring-loaded pistons 17, allowing the handle bar 4 and front fork 2 to rotate toward the rear support 3. Because the center of gravity of the handle bar 4 is typically above the folding mechanism 10, the stroller tends to collapse under its own weight when the release strap 34, is pulled, thus requiring only one free hand to collapse the stroller. Similarly, when unfolding the stroller, lifting the handle bar 4 tends to unfold the stroller. When the stroller fully open, the spring-loaded piston 17, moves between the knife blade followers 15-16, locking the stroller in its operational position.

### 3. Canopy Deployment Mechanism

The mechanism 60 for deploying and retracting a canopy 69 is a novel feature of the present invention. An exploded view of this mechanism is shown in FIG. 4 and a functionality view is shown in FIG. 5. This mechanism consists primarily of a spring-loaded rod 61, a mechanism casing 62, and a rotating piece 63. The casing 62, made from injection molded plastic in the preferred embodiment, is fixed to the handle bar 4 with fasteners 66-67. The rotating piece 63,



made from injection molded plastic in the preferred embodiment, rotates about fastener 68, which mates with the casing 62. Spring 65 fits around rod 61. The spring-loaded rod 61 has a slider joint <sup>62a</sup> with the casing 62 and a pin joint <sup>63b</sup> with the rotating piece 63. Batten 64 is constrained to move with the rotating piece 63 via an interference fit between the two pieces. As the rotating piece 63 rotates, the spring 65 becomes compressed. The compressed spring 65 tends to force the canopy 69 to its open position or to its deployed position depending on whether it has moved more than half way through its range of motion. The motion of the rotating piece 63 is further constrained in its rotation by fastener 67 being seated in groove 63a of the rotating piece 63.

#### 4. Hub Assembly

The hub assembly 40, shown in FIG. 6 serves the following functions:

- 1) Provide a hub for the rear wheel axles.
- 2) Provide a quick release for the rear wheels.
- 3) Provide a rear wheel parking brake, deployable with an easy foot motion.

There are two hub assemblies 40 in the preferred embodiment; one fastened to the end of each of the rear legs 3a-3b. Each rear wheel 31 has its own axle 51. The axle 51 fits into the injection-molded hub assembly case 41 held together with assembly bolts 50, which are housed by the case 41 as well. A notch 52 is machined in the axle 51 in order to mate with a spring-loaded quick release pin 42. The quick release pin 41 prevents the axle 51 from separating from the hub assembly 40. If the user desires to remove a rear wheel 31, the quick release pin 41 is pulled away from the axle 51 and the wheel is easily removed <sup>(not shown)</sup>. The spring 43 pulls the release pin 41 back so that when the axle 51 is reinserted into the hub assembly 40, it snaps securely into place.

In order to prevent the stroller from rolling when parked, a foot activated parking brake feature is designed into the hub assembly 40. A brake lever 44, made from stamped steel in the preferred embodiment, has its fulcrum 45 fixed to the hub assembly case 41. The brake lever 44 has a bulbous end 44a, in the preferred embodiment, to facilitate easy deployment or release of

the brake with a simple foot motion. When the brake lever **44** is rotated down, an appendage **44b** on the brake lever **44** engages with a toothed disk **49**, which is fixed to the rear wheel **31**. It is undesirable to have the brake inadvertently deploy or release. For this reason, an over-center mechanism is included in the preferred embodiment. A spring-loaded rod **46** is pinned to the brake lever **44** and has a slider joint with the hub assembly case **41**. The spring-loaded rod **46** is designed so that the brake lever **44** is most stable in either the fully deployed or fully retracted positions and only a deliberate foot motion from the user will change the foot brake position. In the preferred embodiment, plastic or metal balls are placed on the rod **46** on both sides of the spring **47** in order to prevent the spring **47** from binding on the brake lever **44** or hub assembly case **41**.

### 5. *Folding Sequence*

The folding sequence is outlined here and depicted in FIG. 7:

- 1) Depress foot brake levers **44** on both rear wheels **31** and retract canopy **60**.
- 2) Remove infant from seat **36**.
- 3) Grab hold of the release strap **34**, which is situated in the seat **36**, and lift on the strap **34** and continue to hold it. The release strap **34** will pull on both of the release levers **18**, which retract the spring-loaded pistons **17**. The handle bar **4**, because its center of gravity is above the folding mechanism **10**, will tend to rotate toward the rear support **3**, and because it is geared to the front fork **2**, the front fork **2** will rotate toward the rear support **3** as well.
- 4) The three rigid assemblies **2-4** will be parallel with one another and the stroller is ready for transport or storage. If it is desired to reduce the size of the stroller even more, the quick release pins **42** can be pulled to remove the rear wheels **31** and the front wheel **30** can also be removed